

AMENDMENTS TO THE CLAIMS:

The listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF THE CLAIMS

1-15. (Canceled)

16. (Original) A system for delivering a breathing gas to a patient interface comprising:

a pressure sensor;

a blower;

a valve;

a controller connected to the sensor, blower and valve, the controller comprising a memory having a plurality of executable instructions, wherein the executable instructions comprise:

a first set of instructions sensing a pressure associated with the delivery of the breathing gas to the patient interface;

a second set of instructions changing the valve position in response to a change in the sensed pressure;

a third set of instructions detecting a start of inhalation state by determining if the valve position has increased beyond a start of inhalation state threshold value;

a fourth set of instructions detecting an end of inhalation state by determining if the valve position has fallen below an end of inhalation state threshold value;

a fifth set of instructions delivering the breathing gas at least at a first positive pressure above ambient pressure after detection of the start of inhalation state; and

a sixth set of instructions delivering the breathing gas at least at a second pressure after detection of the end of inhalation state wherein the second pressure is less than the first pressure.

17. (Original) The system of claim 16 further comprising a seventh set instructions delivering the breathing gas from the second pressure to the first pressure according to a predefined function and prior to the detection of the next start of inhalation state.

18. (Original) The system of claim 17 wherein the predefined function is a linear function.

19. (Original) The system of claim 17 wherein the predefined function is associated with a sensed pressure associated with the patient interface.

20. (Original) The system of claim 17 wherein the second pressure comprises at least an ambient pressure.

21-30. (Canceled)

31. (New) A system for providing a breathing gas, including:

means for sensing a parameter associated with delivery of the breathing gas;

first means for changing a control parameter associated with a control element in response to a difference between the sensed parameter and a first predetermined value during an inhalation state of a breathing cycle;

means for determining a transition from the inhalation state to an exhalation state of the breathing cycle based at least in part on the control parameter;

second means for changing the control parameter to cause a first change in the sensed parameter during an unload portion of the exhalation state based at least in part on the determined transition; and

third means for changing the control parameter to cause a second change in the sensed parameter during a load portion of the exhalation state based at least in part on the first predetermined value.

32. (New) The system of claim 31 wherein the sensed parameter is gas pressure, gas flow, gas temperature, or gas composition.

33. (New) The system of claim 31 wherein the control element includes a variable position valve and the control parameter includes a valve step position.
34. (New) The system of claim 31 wherein the control element includes a variable speed blower and the control parameter includes a blower speed.
35. (New) The system of claim 31 wherein the determining means includes means for determining an average valve step position.
36. (New) The system of claim 31 wherein the determining means includes means for identifying an instantaneous valve step position.
37. (New) The system of claim 31 wherein the determining means includes means for determining a peak valve step position.
38. (New) The system of claim 31 wherein the transition from the inhalation state to the exhalation state is based at least in part on a predetermined percentage threshold value.
39. (New) The system of claim 31 wherein the second changing means includes means for determining an inhale time associated with the inhalation state.
40. (New) The system of claim 31 wherein changing the control parameter to cause the first change in the sensed parameter during the unload portion is based at least in part on an unloading function.
41. (New) The system of claim 31 wherein changing the control parameter to cause the first change in the sensed parameter during the unload portion is based at least in part on a second predetermined value.
42. (New) The system of claim 31 wherein the second means for changing includes means for determining a peak valve step position.

43. (New) The system of claim 31 wherein changing the control parameter to cause the second change in the sensed parameter during the load portion is based at least in part on a loading function.

44. (New) An apparatus for providing a breathing gas, including:

means for sensing a breathing gas pressure associated with delivery of the breathing gas;

means for detecting a start of an inhalation state of a breathing cycle;

first means for changing a valve step position associated with a variable position valve in response to a difference between the sensed breathing gas pressure and a first predetermined breathing gas pressure value during the inhalation state;

means for determining a transition from the inhalation state to an exhalation state of the breathing cycle based at least in part on the changing valve step position;

second means for changing the valve step position to cause a first change in the breathing gas pressure during an unload portion of the exhalation state based at least in part on the determined transition; and

third means for changing the valve step position to cause a second change in the breathing gas pressure during a load portion of the exhalation state based at least in part on the first predetermined breathing gas pressure value.

45. (New) The apparatus of claim 44, the detecting means including:

means for determining an average valve step position;

means for integrating a difference between an instantaneous valve step position and the average valve step position over a predetermined integration time to produce a summation; and

means for identifying the start of the inhalation state after the summation is greater than a predetermined start of inhalation threshold value.

46. (New) The apparatus of claim 44, the determining means including:

means for calculating a first transition variable based at least in part on an instantaneous valve step position;

means for calculating a second transition variable based at least in part on a peak valve step position; and

means for identifying the transition from the inhalation state to the exhalation state after the first transition variable is less than or equal to the second transition variable.

47. (New) The apparatus of claim 44, the second changing means including:

means for determining an inhale time associated with the inhalation state;

means for determining an exhale time associated with the unload portion of the exhalation state and based at least in part on the determined inhale time;

means for beginning the exhale time after the transition from the inhalation state to the exhalation state;

means for decrementing the valve step position according to an unloading function until a second predetermined breathing gas pressure value is achieved; and

means for changing the valve step position in response to a difference between the sensed breathing gas pressure and the second predetermined breathing gas pressure value after the second predetermined breathing gas pressure value is achieved and until the exhale time expires.

48. (New) The apparatus of claim 44, the third changing means including:

means for incrementing the valve step position according to a loading function until the first predetermined breathing gas pressure value is achieved; and

means for changing the valve step position in response to a difference between the sensed breathing gas pressure and the first predetermined breathing gas pressure value after the first predetermined breathing gas pressure value is achieved.

49. (New) An apparatus for providing a breathing gas, including:

means for sensing a breathing gas pressure associated with delivery of the breathing gas;

first means for determining a breath cycle time associated with at least a portion of a current inhalation state of a current breathing cycle and a portion of a previous breathing cycle;

first means for changing a valve step position associated with a variable position valve in response to a difference between the sensed breathing gas pressure and a first predetermined breathing gas pressure value during the current inhalation state;

second means for determining a transition from the current inhalation state to a current exhalation state of the current breathing cycle based at least in part on the changing valve step position;

second means for changing the valve step position to cause a first change in the breathing gas pressure during an unload portion of the current exhalation state based at least in part on the determined transition; and

third means for changing the valve step position to cause a second change in the breathing gas pressure during a load portion of the current exhalation state based at least in part on the first predetermined breathing gas pressure value.

50. (New) The apparatus of claim 49, the first determining means including:

means for determining a peak valve step position for a previous inhalation state of the previous breathing cycle;

means for starting a breath cycle timer after the peak valve step position for the previous breathing cycle is determined;

means for determining a peak valve step position for the current inhalation state; and

means for stopping the breath cycle timer after the peak valve step position for the current inhalation state is determined.

51. (New) The apparatus of claim 49, the second determining means including:

means for calculating a first transition variable based at least in part on an instantaneous valve step position;

means for calculating a second transition variable based at least in part on a peak valve step position; and

means for identifying the transition from the current inhalation state to the current exhalation state after the first transition variable is less than or equal to the second transition variable.

52. (New) The apparatus of claim 49, the second changing means including:

means for determining an unloading time associated with the unload portion of the current exhalation state and based at least in part on the determined breath cycle time;

means for beginning the unloading time after the transition from the current inhalation state to the current exhalation state;

means for decrementing the valve step position according to an unloading function until a second predetermined breathing gas pressure value is achieved; and

means for changing the valve step position in response to a difference between the sensed breathing gas pressure and the second predetermined breathing gas pressure value after the second predetermined breathing gas pressure value is achieved and until the unloading time expires.

53. (New) The apparatus of claim 49, the third changing means including:

means for determining a loading time associated with the load portion of the current exhalation state and based at least in part on the determined breath cycle time;

means for beginning the loading time after the unload portion of the current exhalation state;

means for incrementing the valve step position according to a loading function until the first predetermined breathing gas pressure value is achieved; and

means for changing the valve step position in response to a difference between the sensed breathing gas pressure and the first predetermined breathing gas pressure value after the first predetermined breathing gas pressure value is achieved and until the loading time expires.

54. (New) A method of providing a breathing gas, including:

a) sensing a parameter associated with delivery of the breathing gas;

b) adjusting a blower speed in response to a difference between the sensed parameter and a first predetermined value during an inhalation state of a breathing cycle;

c) detecting a transition from the inhalation state to an exhalation state of the breathing cycle based at least in part on the sensed parameter;

d) reducing the blower speed to drop a pressure associated with delivery of the breathing gas for a first time portion based at least in part on an exhalation unloading function; and

e) increasing the blower speed to increase a pressure associated with delivery of the breathing gas for a second time portion based at least in part on an exhalation loading function until the sensed parameter exceeds the first predetermined value.

55. (New) An apparatus for providing a breathing gas, including:
a variable speed blower adapted to pressurize the breathing gas;
a sensor adapted to sense a parameter associated with delivery of the breathing gas;
a controller in communication with the variable speed blower and the sensor and adapted to i) adjust the speed of the blower in response to a difference between the sensed parameter and a first predetermined value during an inhalation state of a breathing cycle, ii) detect a transition from the inhalation state to an exhalation state of the breathing cycle based at least in part on the sensed parameter, iii) reduce the blower speed for a first time portion based at least in part on an exhalation unloading function, and iv) increase the blower speed for a second time portion based at least in part on an exhalation loading function until the sensed parameter exceeds the first predetermined value.
56. (New) An apparatus for providing a breathing gas, including:
a blower;
means for sensing a parameter associated with delivery of the breathing gas;
means for adjusting a blower speed in communication with the blower and sensing means wherein the adjusting is in response to a difference between the sensed parameter and a first predetermined value during an inhalation state of a breathing cycle;
means for detecting a transition from the inhalation state to an exhalation state of the breathing cycle in communication with the sensing means, wherein the detecting is based at least in part on the sensed parameter;
means for reducing the blower speed to drop a pressure associated with delivery of the breathing gas in communication with the blower and detecting means, wherein the reducing is for a first time portion based at least in part on an exhalation unloading function; and
means for increasing the blower speed to increase a pressure associated with delivery of the breathing gas in communication with the blower and the reducing means, wherein the increasing is for a second time portion based at least in part on an exhalation loading function until the sensed parameter exceeds the first predetermined value.